Amendment and Response
Applicant: Niranjan Dumera-Venkata et al.
Serial No.: 10/762,845
Filed: September 26, 2003
Docket No.: 200312385-1
Title: GENERATING AND DISPLAYING SPATIALLY OFFSET SUB-FRAMES

IN THE CLAIMS

Please amend claim 1 as follows:

1.(Currently Amended)   A method of displaying an image with a display device, the method comprising:

    receiving a first set of image data for a first image;

    generating a first sub-frame and a second sub-frame corresponding to the first set of image data;

    reducing a bit-depth of the first and the second sub-frames differently based on different quantization equations in a first set of quantization equations, thereby generating a first dithered sub-frame and a second dithered sub-frame; and

    alternating between displaying the first dithered sub-frame in a first position and displaying the second dithered sub-frame in a second position spatially offset from the first position.

2.(Original)   The method of claim 1, wherein the first set of quantization equations includes two different quantization equations.

3.(Original)   The method of claim 2, wherein the bit-depth of the first sub-frame is reduced based on a first of the two quantization equations, and the bit-depth of the second sub-frame is reduced based on a second of the two quantization equations.

4.(Original)   The method of claim 1, wherein the first set of quantization equations includes four different quantization equations.

5.(Original)   The method of claim 4, wherein the bit-depth of the first sub-frame is reduced based on first and second ones of the four quantization equations, and the bit-depth of the second sub-frame is reduced based on third and fourth ones of the four quantization equations.

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6.(Original)   The method of claim 1, and further comprising:

    generating a third sub-frame and a fourth sub-frame corresponding to the first set of image data;

    reducing a bit-depth of the third and the fourth sub-frames based on the first set of quantization equations, thereby generating a third dithered sub-frame and a fourth dithered sub-frame; and

    wherein alternating between displaying the first dithered sub-frame and displaying the second dithered sub-frame further includes alternating between displaying the first dithered sub-frame in the first position, displaying the second dithered sub-frame in the second position, displaying the third dithered sub-frame in a third position spatially offset from the first position and the second position, and displaying the fourth dithered sub-frame in a fourth position spatially offset from the first position, the second position, and the third position.

7.(Original)   The method of claim 1, and further comprising:

    receiving a second set of image data for a second image;

    generating a third sub-frame and a fourth sub-frame corresponding to the second set of image data;

    reducing a bit-depth of the third and the fourth sub-frames based on a second set of quantization equations, thereby generating a third dithered sub-frame and a fourth dithered sub-frame; and

    alternating between displaying the third dithered sub-frame in the first position and displaying the fourth dithered sub-frame in the second position.

8.(Original)   The method of claim 7, wherein the first and the second images are consecutive images.

9.(Original)   The method of claim 7, wherein the first and the second sets of quantization equations each include two different quantization equations, and wherein the two

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quantization equations in the first set are different than the two quantization equations in the second set.

10.(Original) The method of claim 9, wherein the bit-depth of the third sub-frame is reduced based on a first of the two quantization equations in the second set, and the bit-depth of the fourth sub-frame is reduced based on a second of the two quantization equations in the second set.

11.(Original) The method of claim 7, wherein the first and the second sets of quantization equations each include four different quantization equations, and wherein the four quantization equations in the first set are different than the four quantization equations in the second set.

12.(Original) The method of claim 11, wherein the bit-depth of the third sub-frame is reduced based on first and second ones of the four quantization equations in the second set, and the bit-depth of the fourth sub-frame is reduced based on third and fourth ones of the four quantization equations in the second set.

13.(Original) The method of claim 1, wherein the step of reducing a bit-depth is performed using at least one array of dither values, the method further comprising:

      identifying a dither value from the at least one array for each pixel in the first and the second sub-frames based on a spatial location of the pixel and a temporal location of the sub-frame containing the pixel; and

      reducing a bit-depth of each pixel in the first and the second sub-frames based on the identified dither value for the pixel.

14.(Original) The method of claim 13, wherein the at least one array of dither values is configured based on minimization of an error between a test sequence of high resolution images and simulated high resolution images generated from dithered sub-frames.

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15.(Original) The method of claim 14, wherein the error is weighted based on characteristics of a human visual system.

16.(Original) A system for displaying an image, the system comprising:

a buffer adapted to receive a first set of image data for a first image;

an image processing unit configured to define first and second sub-frames corresponding to the first set of image data, and generate corresponding first and second dithered sub-frames by quantizing pixel values of the first sub-frame using a first set of dither values, and quantizing pixel values of the second sub-frame using a second set of dither values; and

a display device adapted to alternately display the first dithered sub-frame in a first position and the second dithered sub-frame in a second position spatially offset from the first position.

17.(Original) The system of claim 16, wherein the first and second sets of dither values each include a single dither value.

18.(Original) The system of claim 16, wherein the first and second sets of dither values each include at least two dither values.

19.(Original) The system of claim 16, wherein each pixel value is quantized by dividing a sum of the pixel value and a dither value by a first value, taking a floor of the result of the division, and multiplying the result of the floor by the first value.

20.(Original) The system of claim 16, wherein the buffer is adapted to receive a second set of image data for a second image, and the image processing unit is configured to define a third sub-frame and a fourth sub-frame corresponding to the second set of image data, and generate corresponding third and fourth dithered sub-frames by quantizing pixel values of the third sub-frame using a third set of dither values, and quantizing pixel values of the fourth sub-frame using a fourth set of dither values.

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21.(Original) The system of claim 20, wherein the display device is adapted to alternately display the third dithered sub-frame in the first position and the fourth dithered sub-frame in the second position.

22.(Original) A system for generating low resolution dithered sub-frames for display at spatially offset positions to generate the appearance of a high resolution image, the system comprising:

      means for receiving image data for a plurality of high resolution images;

      means for generating a plurality of sets of low resolution sub-frames based on the image data, each set of low resolution sub-frames corresponding to one of the high resolution images; and

      means for spatially and temporally dithering the plurality of sets of low resolution sub-frames to generate a corresponding plurality of sets of low resolution dithered sub-frames.

23.(Original) The system of claim 22, wherein the plurality of high resolution images includes first and second sets of high resolution images, and wherein the means for spatially and temporally dithering comprises:

      means for quantizing each set of sub-frames corresponding to high resolution images in the first set based on a plurality of even dither values, and quantizing each set of sub-frames corresponding to high resolution images in the second set based on a plurality of odd dither values.

24.(Original) A computer-readable medium having computer-executable instructions for performing a method of generating low resolution dithered sub-frames for display at spatially offset positions to generate the appearance of a high resolution image, comprising:

      receiving image data for first and second sets of high resolution images;

      generating a plurality of sets of low resolution sub-frames based on the image data, each set of sub-frames corresponding to one of the high resolution images;

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quantizing each set of sub-frames corresponding to high resolution images in the first
set based on a first plurality of dither values;

quantizing each set of sub-frames corresponding to high resolution images in the
second set based on a second plurality of dither values that is different than the
first plurality of dither values; and

wherein the quantizing steps provides a spatial and temporal dither of the sub-frames.

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